AIR FORCE
QUALIFICATION TRAINING PACKAGE (AFQTP)

FOR

UTILITIES SYSTEMS

(3E4X1)

MODULE 26

WATER TESTING

TABLE OF CONTENTS

MODULE 26

WATER TESTING

Career Field Education and Training Plan (CFETP) references from 1 Jul 02 version.

OPR: HQ AFCESA/CEOF
(SMSgt James B. Lucas)
Supersedes AFQTP 3E4X1-25, 1 Oct 1999

Certified by: HQ AFCESA/CEOF
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Pages: 19/Distribution F

AIR FORCE QUALIFICATION TRAINING PACKAGES
FOR
UTILITIES SYSTEMS
(3E4X1)

INTRODUCTION

Before starting this AFQTP, refer to and read the "AFQTP TRAINER/TRAINEE GUIDE."

AFQTPs are mandatory and must be completed to fulfill task knowledge requirements on core and diamond tasks for upgrade training. ***It is important for the trainer and trainee to understand*** that an AFQTP ***does not*** replace hands-on training, nor will completion of an AFQTP meet the requirement for core task certification. AFQTPs will be used in conjunction with applicable technical references and hands-on training.

AFQTPs and Certification and Testing (CerTest) must be used as minimum upgrade requirements for Diamond tasks.

MANDATORY minimum upgrade requirements:

Core task:
AFQTP completion
Hands-on certification

Diamond task:
AFQTP completion
CerTest completion (80% minimum to pass)

Note: *Trainees will receive hands-on certification training for Diamond Tasks when equipment becomes available either at home station or at a TDY location*.

Put this package to use. Subject matter experts under the direction and guidance of HQ AFCESA/CEOF revised this AFQTP. If you have any recommendations for improving this document, please contact the Career Field Manager at the address below.

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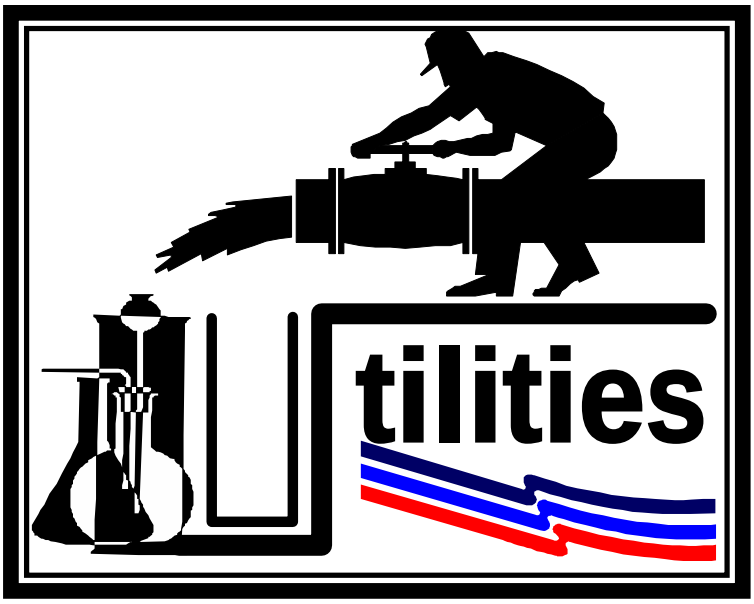
Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.



WATER TESTING

MODULE 26 **AFQTP UNIT 1**

COLLECT WATER SAMPLES (26.1.)

COLLECT WATER SAMPLES

Task Training Guide

STS Reference Number/Title:	26.1., Collect water samples.
Training References:	1. CD-ROM Air Force Qualification Training Package (AFQTP) 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*. 2. Technical Order (TO) 40W4-13-41, *Operator Manual, Water Purification Unit, Reverse Osmosis*. 3. TO 40W4-14-1, Harvest Eagle Water Distribution System.
Prerequisites:	1. **Possess as a minimum a 3E431 AFSC.** 2. **Review TOs 40W4-13-41 and 40W4-14-1.** 3. **Complete CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*.**
Equipment/Tools Required:	1. Approved sampling container. 2. Computer to support AFQTP.
Learning Objective:	Trainee will understand the steps to collect samples.
Samples of Behavior:	Trainee will be able to collect water samples.
Notes:	
1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure.	

COLLECT WATER SAMPLES

1. Background: There are many reasons to collect numerous samples. But, how you collect a sample can dictate what your results will be. The three important factors when collecting samples are **where, when,** and **why.** Annotate where the sample was collected and why the sample was collected. The time the sample was collected is very crucial as well. If taking a sample during peak usage in a pool, hydrant, tap, waste plant, or water plant, the results of the samples will differ if taken at a low usage period.

1.1. There are methods of collecting samples:

1.1.1. A grab sample is a single sample of wastewater that is collected from a sampling point to show the "real time" conditions.

1.1.2. Composite samples are collections from a sampling point and a representation of what has transpired over a period of time. The details and care in collecting samples cannot be over-emphasized.

1.2. The label used on the sample should have the following information:

1.2.1. Name of the person collecting the sample.

1.2.2. Date sample was obtained.

1.2.3. Temperature of the sample.

1.2.4. Where the sample was collected (source).

1.2.5. Type of analysis to be performed.

2. ***Complete the CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: Water Testing. Upon completion of the above-mentioned CD-ROM, properly collect a water sample using the step-by-step procedures listed below.***

> **NOTE:**
> The review questions for this material are contained in the above-mentioned CD-ROM.

3. ***To perform this task, follow these steps:***

Step 1: Gather required equipment.

> **NOTE:**
> Collect samples in containers free from any contaminants. If the sample container or stopper is contaminate, rinse the container free of contaminants or replace it with a sanitized container.

Step 2: Remove the stopper or lid used to protect sample jar or tube.

Step 3: Rinse the container with the water to be tested.

3.1. <u>Wells</u>. Pump the water in the well until normal usage peak occurs.

3.2. Surface supplies. Take samples from the deepest and best flow of the stream or lake.

3.3. Treatment Plant. Take water samples from channels, pipe taps where water is well **mixed.**

3.4. Tap or Distribution System. Allow the water to run for to flush the line for 3-5 minutes; then collect sample.

NOTE:

It is best if you fill and rinse the sample container three times before collecting the sample; however, if a bacteriological, dissolved oxygen, etc. is performed, **DO NOT** rinse. These sample bottles are pre-prepared or pre-sanitized and rinsing will remove the sodium thiosulfate or other neutralizing agents.

Step 4: Common Procedure for Pools or Lakes.

4.1. Plunge the container into the water, holding the mouth down and keeping it at about a 45-degree angle at least three inches beneath the surface.

4.2. Tilt the container up and allow air to escape as the bottle fills, all the while moving it in a direction away from your hand so that water that has touched your hand does not enter the container.

4.3. Then, discard a quarter of the water.

Step 5: Replace stopper or lid.

Step 6: Annotate the time, place, and reason for sample.

Step 7: Take sample to be tested or stored.

HINT:

Caution must be taken to keep the rim and interior of the container free of contamination during the time of collecting the sample.

COLLECT WATER SAMPLES

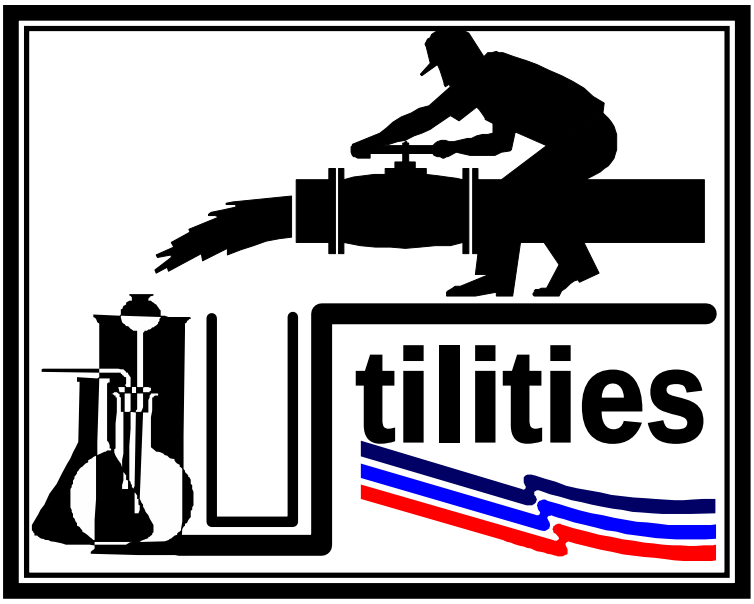
PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Identify all the equipment needed for the job		
2. Take proper safety precautions		
3. Properly collect samples following the AFQTP: 3.1. Gather required equipment. 3.2. Remove the stopper or lid used to protect sample jar or tube. 3.3. Rinse the container with the water to be tested. 3.4. Replace stopper or lid. 3.5. Annotate the date, place, temperature of sample, and reason sample was collected. 3.6. Take sample to be tested or stored**.**		
4. Understand how to collect samples		
5. Complete the questions in the AFQTP CD-ROM: 5.1. Score 80% or higher 5.2. Trainer review and explain all missed questions		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



PERFORM WATER TESTS

MODULE 26 AFQTP UNIT 2

PH (26.2.1.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM PH WATER TEST

Task Training Guide

STS Reference Number/Title:	26.2.1., Perform pH water test.
Training References:	1. Career Development Course (CDC) 3E451, *Utilities Systems*. 2. CD-ROM Air Force Qualification Training Package (AFQTP) 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*. 3. TO 40W4-13-41, *Operator Manual, Water Purification Unit, Reverse Osmosis*.
Prerequisites:	1. **Possess as a minimum a 3E431 AFSC.** 2. **Review T.O. 40W4-13-41.** 3. **Complete CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*.**
Equipment/Tools Required:	1. Color comparator with indicator tablets. 2. Computer to support CD-ROM AFQTP.
Learning Objective:	The trainee will know the steps required to perform a pH test on a water source.
Samples of Behavior:	Trainee will be able to perform pH water test.
Notes:	
1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure.	

PERFORM PH WATER TEST

1. Background: The relative strength of an acid or base is expressed in terms of pH. This is a unit measure of the number of free hydrogen ions (H^+) in a solution as compared to pure water. The pH scale has a range of 0 to 14.

1.1. A pH reading of 6.9 and below indicates the sample is more acidic.

1.2. If there were equal amounts of H^+ and OH ions in a solution this would indicate a neutral sample or a pH reading of 7.0.

1.3. A pH reading of 7.01 - 14 would show that the sample was more alkaline.

2. ***Complete the CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: Water Testing. Upon completion of the above-mentioned CD-ROM, properly perform a pH test using the step-by-step procedures listed below.***

> **NOTE:**
> The review questions for this material are contained in the above-mentioned CD-ROM.

3. ***To perform this task, follow these steps:***

Step 1: Get the test kit

1.1. Having the proper equipment (in working order) will save valuable time and avoid round-trips to the shop. Not being prepared will cause unnecessary delays and ultimately higher labor costs.

Step 2: Check the color comparator.

2.1. Ensure the appropriate disk is installed to test for pH.

> **NOTE:**
> Different color disks are used for testing pH and chlorine residual.

Step 3: Check sample tubes. Ensure the unit has two glass sample tubes.

Step 4: Rinse sample tubes.

4.1. Rinse both tubes and their caps three times with water to be tested.

Step 5: Collect sample.

5.1. Fill both tubes to appropriate fill line (5 ml) with sample water.

Step 6: Position blank in the color comparator.

6.1. Place the tube of untreated water sample in the left top opening of the color comparator, this is known as the blank sample. (See Figure 1.)

Step 7: Add indicator.

7.1. Using your index finger Push out the phenol red tablet from the foil and allow it to fall into the tube. Install the cap and swirl tube for 10 seconds to mix contents. (See Figure 2.)

NOTE:
Touching tablet with fingers or not using cap may cause inaccurate reading.

Step 8: Position sample in the color comparator.

8.1. Insert tube of treated water sample in the right top opening of the comparator; give it a few seconds for the chemical to react. (See Figure 3.)

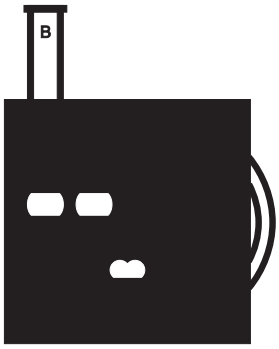


Figure 1. Placing the Blank

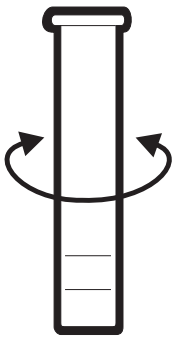


Figure 2. Swirling the Sample

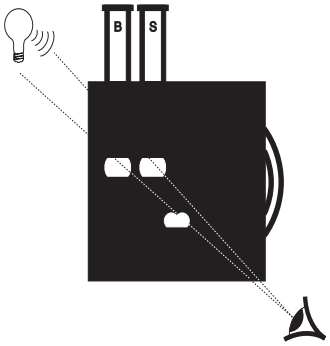


Figure 3. Comparing the Blank and the Sample

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Step 9: Compare the blank and the sample.

9.1. Elevate the color comparator to eye level up to a light such as the sky, window, or lamp, rotating disk until the closest match is achieved. (See Figure 3.)

Step 10: Take reading.

10.1. Obtain reading through scale window.

NOTE:
It is important that results are read within one minute after mixing samples.

Step 11: Record reading.

11.1. Write down reading in mg/l or ppm.

Step 12: Clean up.

12.1. Discard sample and rinse tubes with water.

SAFETY:
THE CHEMICALS IN THE KIT MAY BE HAZARDOUS TO THE HEALTH AND SAFETY OF THE USER IF INAPPROPRIATELY HANDLED. PLEASE READ ALL WARNINGS BEFORE PERFORMING THE TEST AND USE APPROPRIATE SAFETY EQUIPMENT.

PERFORM PH WATER TEST

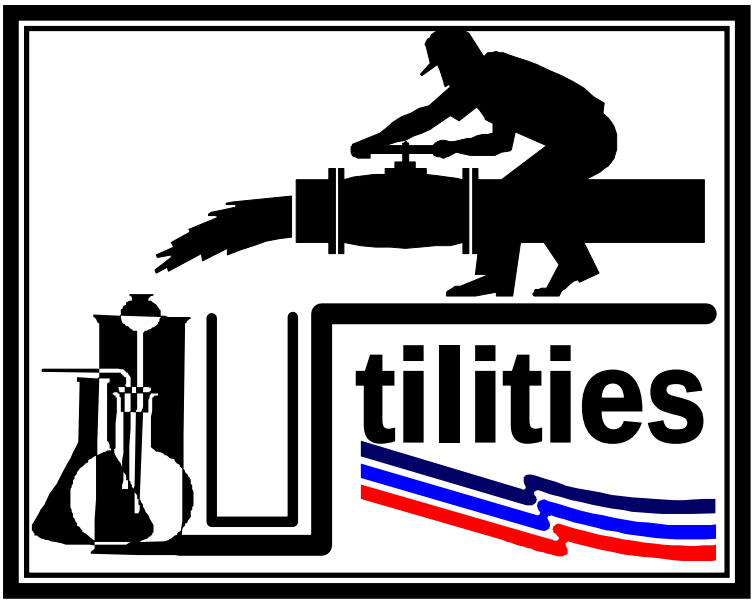
PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Identify all the equipment needed for the job		
2. Take proper safety precautions		
3. Perform the test following the steps in the AFQTP: 3.1. Get the test kit 3.2. Check the color comparator 3.3. Check sample tubes 3.4. Collect sample 3.5. Position blank in the color comparator 3.6. Add indicator 3.7. Position sample in the color comparator 3.8. Compare the blank and the sample 3.9. Take reading 3.10. Record reading 3.11. Clean up		
4. Complete the questions in the AFQTP: 4.1. Score 80% or higher 4.2. Trainer review and explain all missed questions		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.



PERFORM WATER TESTS

MODULE 26 AFQTP UNIT 2

CHLORINE RESIDUAL (26.2.2.)

Notice. This AFQTP is *NOT* intended to replace the applicable technical references nor is it intended to replace hands-on training. It is to be used in conjunction with these for training purposes only.

PERFORM CHLORINE RESIDUAL TEST

Task Training Guide

STS Reference Number/Title:	26.2.2., Perform chlorine residual test.
Training References:	1. Career Development Course (CDC) 3E451, Utilities Systems. 2. CD-ROM Air Force Qualification Training Package (AFQTP) 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*. 3. Technical Order (TO) 40W4-13-41, *Operator Manual, Water Purification Unit, Reverse Osmosis*.
Prerequisites:	1. **Possess as a minimum a 3E431 AFSC.** 2. **Review TO 40W4-13-41.** 3. **Complete CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: *Water Testing*.**
Equipment/Tools Required:	1. Color comparator with free available chlorine packets. 2. Computer to support CD-ROM AFQTP.
Learning Objective:	The trainee will know the steps required to accurately perform Chlorine Residual test on a given water source.
Samples of Behavior:	1. Trainee will be able to name the equipment required to perform chlorine residual test. 2. Trainee will know required steps to perform chlorine residual test.
Notes:	
1. To successfully complete this element, the steps must be followed exactly--no exceptions. 2. Any safety violation is an automatic failure.	

PERFORM CHLORINE RESIDUAL TEST

1. Background: Chlorine (Cl2) is added to a drinking water supply, wastewater treatment plant effluent, and swimming pools to kill bacteria that are harmful to humans. Chlorine also removes odors in water. **Residual** Cl2 is the amount of chlorine remaining in the water of a distribution system after the Cl2 **demand** (impurities in the sample) is contacted.

2. Complete the CD-ROM AFQTP 3E4X1 Utilities, Version 1.0, Dec 99: Water Testing. Upon completion of the above-mentioned CD-ROM, properly perform chlorine residual test using the step-by-step procedures listed below.

> **NOTE:**
> The review questions for this material are contained in the above-mentioned CD-ROM.

3. *To perform this task, follow these steps:*

Step 1: Gather required equipment.

1.1. The first step of a task is often the one that could cause or cure unnecessary problems down the line. Having the proper equipment (in working order) will save valuable time and avoid round-trips to the shop. Not being prepared will cause unnecessary delays and ultimately higher labor costs.

Step 2: Check the color comparator.

2.1. Check color comparator to ensure Cl2 disk is installed.

> **NOTE:**
> Different color disk is used for testing pH and chlorine residual.

Step 3: Check sample tubes.

3.1. Ensure the unit has two glass sample tubes.

Step 4: Rinse sample tubes.

4.1. Rinse both tubes and their caps twice with water to be tested.

Step 5: Collect sample.

5.1. Fill both tubes to appropriate fill line (5 ml) with sample water.

Step 6: Position blank in the color comparator.

6.1. Place the tube of untreated water sample in the left top opening of the color comparator, this is known as the blank sample. (See Figure 1.)

Step 7: Add indicator.

7.1. Use your index finger to punch out the N N-diethyl-p-phenylenediamine (DPD) tablet from the foil and allow it to fall into the tube.

7.2. Avoid direct contact with your hands and the indicator.

7.3. Cap the sample tube and swirl for 10 seconds to mix contents. (See Figure 2.)

NOTE:
Never use your fingers as a replacement for the cap, doing so may cause an inaccurate reading.

Step 8: Position sample in the color comparator.

8.1. Insert tube of treated water sample in the right top opening of the color comparator; give it three minutes for the chemical to react.

NOTE:
All the tablet or powder **DOES NOT** have to dissolve to get a correct reading.

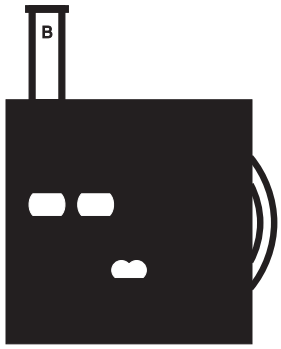


Figure 1. Placing the Blank

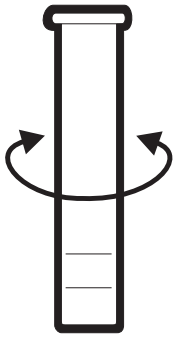


Figure 2. Swirling the Sample

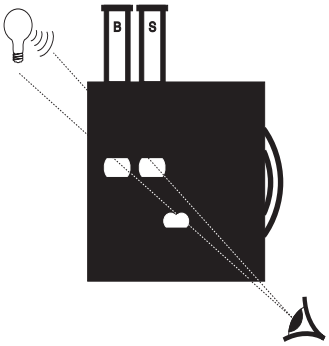


Figure 3. Comparing the Blank and the Sample

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Step 9: Compare the blank and the sample.

9.1. Elevate the color comparator to eye level up to a light such as the sky, window, or lamp, rotating disk until the closest match is achieved. (See Figure 3.)

Step 10: Take reading.

10.1. Obtain reading through scale window.

NOTE:
It is important that results are read within one minute after mixing samples.

Step 11: Record reading.

11.1. Write down reading in mg/l or ppm.

Step 12: Clean up.

12.1. Discard sample and rinse tubes with water.

SAFETY:
THE CHEMICALS IN THE KIT MAY BE HAZARDOUS TO THE HEALTH AND SAFETY OF THE USER IF INAPPROPRIATELY HANDLED. PLEASE READ ALL WARNINGS BEFORE PERFORMING THE TEST AND USE APPROPRIATE SAFETY EQUIPMENT.

PERFORM CHLORINE RESIDUAL TEST

PERFORMANCE CHECKLIST

INSTRUCTIONS:

The trainee must satisfactorily perform all parts of the task without assistance. Evaluate the trainee's performance using this checklist.

DID THE TRAINEE….?	YES	NO
1. Identify all the equipment needed for the job		
2. Take proper safety precautions		
3. Perform the test following the steps in the AFQTP: 3.1. Gather required equipment 3.2. Check the color comparator 3.3. Check sample tubes 3.4. Rinse sample tubes with source water 3.5. Collect sample 3.6. Position blank in the color comparator 3.7. Add indicator 3.8. Position sample in the color comparator 3.9. Compare the blank and the sample 3.10. Take reading 3.11. Record reading 3.12. Clean up		
4. Complete the questions in the CD-ROM AFQTP: 4.1. Score 80% or higher 4.2. Trainer review and explain all missed questions		

FEEDBACK: Trainer should provide both positive and/or negative feedback to the trainee immediately after the task is performed. This will ensure the issue is still fresh in the mind of both the trainee and trainer.

MEMORANDUM FOR HQ AFCESA/CEOF
139 Barnes Drive Suite 1
Tyndall AFB, FL 32403-5319

FROM:

SUBJECT: Qualification Training Package Improvement

1. Identify module.

   Module # and title_____

2. Identify improvement/correction section(s):

   _____ STS Task Reference
   _____ Training Reference
   _____ Evaluation Instructions
   _____ Performance Resources
   _____ Steps in Task Performance
   _____ Performance Checklist
   _____ Feedback
   _____ Format
   _____ Other

3. Recommended changes--use a continuation sheet if necessary.

   _____
   _____
   _____
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   _____

4. You may choose to call in your recommendations to DSN 523-6392 or FAX DSN/Commercial 523-6488 or (850) 283-6488 or email ceof.helpdesk@tyndall.af.mil.

5. Thank you for your time and interest.

YOUR NAME, RANK, USAF
Title/Position